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(54) Vapor phase corrosion inhibitor-desiccant material

Dampfphasenkorrosioninhibierendes und trocknendes Material

Matériau inhibiteur de la corrosion en phase vapeur et dessiccatif

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Description

FIELD OF THE INVENTION

The present invention relates to a formulation which is adapted for use as a vapor phase corrosion inhibitor-desiccant, the material being useful for either inhibiting the corrosion of the metallic items and/or passivating the surfaces thereof, the formulation being particularly adapted for direct incorporation within foam by impregnation therein or within synthetic resinous films through extrusion or deposition into a film, such as into an olefinic film, polyethylene, or the like. Film products prepared in accordance with the present invention find particular application in the formation of enclosures about metallic articles susceptible to corrosion, and provide a relatively dry corrosion inhibiting atmosphere therewithin. Air-permeable capsules and impregnated foam products prepared in accordance with the invention find application in their placement at the site of the items to be protected.

US-A-5 209 869 discloses a vapor phase corrosion inhibitor desiccant wherein the vapor phase corrosion inhibitor is a mixture of amine benzoates, amine nitrates and benzotriazole and wherein the desiccant component of the formulation is a solid-phase granular particle consisting essentially of silica gel onto which the vapor phase corrosion inhibitor component, in powdered form, has been deposited thereon. These compositions provide a vapor phase corrosion inhibitor-desiccant which may be extruded along with a film material, with the film thereafter being utilized to form an enclosure housing the item or items being protected. Alternatively, the compositions may be placed within enclosures or packages containing items which are to be protected from corrosion. One manner in which this approach is effective is to provide an air-permeable capsule or other similar container containing the compositions therein. Of course, the capsule or other container must have sufficient permeability so that the components of the corrosion inhibitor-desiccant therein can enter the ambient environment of the items to be protected. A second manner in which the corrosion inhibitor-desiccant compositions can be placed within enclosures or packages containing items to be protected is to impregnate foam with the compositions and then place the foam in proximity to the items.

The formulation is preferably extruded into polyethylene film at a concentration of from between about 2% and 3% by weight. It is preferably impregnated into foam at a concentration of from between about 1% and 30% by weight. Preferably, the silica gel particulate material has an average particle size ranging from between about 2μm and 8μm, with the vapor phase corrosion inhibitor component deposited on the surface of the granules having a size ranging from between about .001 micron and 0.1 micron.

As an added feature of the invention, film materials extruded with the formulations of the present invention may, in turn, be laminated to a second metallized film, such as, for example, metallized polyethylene terephthalate. The combined laminate provides a means to reduce and/or eliminate static build-up in or along the film, and accordingly improves the properties of the film when employed as an enclosure.

BACKGROUND OF THE INVENTION

In commerce and industry today, the useful life of corrodible items may be extended and/or preserved by providing corrosion inhibitors which protect the corrodible item from the adverse effects of its ambient environment. Corrosion inhibitors, particularly vapor phase corrosion inhibitors, have been found useful in protecting certain corrodible items against reaction with elements or compounds which may be found within their environment, and thereby losing their effectiveness, reducing their useful life, or otherwise diminishing their value. Such protection is typically needed during times of packaging, handling, shipment, or during end use. Elements or compounds which are normally of primary concern are gases such as oxygen, water vapor, sulfides, carbon dioxide, and the like. The vapor phase corrosion inhibitor-desiccant formulations of the present invention find particular application in the preparation of packaging material and in the preparation of formulation-impregnated foam. Packaging material is produced through in-situ extrusion of the material with films, with the films thereafter being utilized to form an envelope or other enclosure about the article being protected. The films may also be employed as a member of a multi-layer laminate including a metallized film having good tear resistant properties such as stress-oriented polyethylene terephthalate containing a vapor deposited film or layer of metallic aluminum on a surface thereof. Such films are commercially available and are commonly designated as "aluminized" films. Foam impregnation is accomplished by liquid dispersion, as known in the art, of the formulations into the foam, followed by controlled evaporation of the liquid carrier to thereby deposit the formulations in the cellular interstices of the foam. The resultant product can be placed in proximity to items to be protected, with such protection occurring as the corrosion inhibitor-desiccant is released from the foam.

Among the common indications of corrosion manifested in useful metallic articles are oxidation, pitting, tarnishing, mottling, or discoloration of the surfaces of these items. These manifestations occur in the articles, particularly when exposed to oxygen and in either gaseous or liquid phase. Additionally, sulfides may present corrosion or tarnishing problems as well. Inasmuch as both oxygen and water, including water vapor, occur normally and are available in nature, it is normally necessary to take precautions against corrosion when packaging metallic items for shipment or storage, or when subjecting such items to normal use. Metals which are frequently found to be susceptible to corrosion under

normal atmospheric and ambient conditions are iron, copper, brass, aluminum, silver, and alloys of these metals. The formulations of the present invention are particularly useful in providing protection to both ferrous and non-ferrous metals, including such non-ferrous metals as aluminum, copper and brass. Care must frequently be taken to protect articles fabricated from such metals, even when their surfaces have been treated so as to be provided with sacrificial or aesthetic coatings of zinc or cadmium on their surfaces. Such sacrificial or aesthetic coatings are, of course, in wide use, but restrictions of use of these materials may appear from time to time due to their potential contribution to pollution or the like. Accordingly, means must be provided to find alternate techniques for the protection and/or preservation of metallic articles.

In the past, it has been known to provide a package or other enclosure which includes one or more inhibiting compounds along with the corrodible item or items to be protected. Additionally, articles have been protected by means of utilization of protective coatings in the form of solids, liquids, greases, or pastes, however such coatings tend to be temporary in nature and further present certain disadvantages to normal handling and packaging. Furthermore, removal of such protective coatings may present problems either due to incomplete removal, or the costs of such removal. The composite vapor phase corrosion inhibitor-desiccant formulations of the present invention find application as a solid phase composite which may be impregnated into foam or be coextruded with film which is to form an enclosure about an article being protected.

Solid phase and liquid phase compounds have been used in the past to provide a source of vapor phase corrosion inhibitors. These materials typically undergo either evaporation or sublimation so as to provide the substantially constant availability of the inhibitors. In other words, vapor phase corrosion inhibitors typically emit vapors which protect corrodible surfaces through the deposition or condensation of a protective film or coating upon the surface. In order to be assured that a constant supply of inhibitor be present, adequate quantities of the solid phase or liquid phase corrosion inhibiting compounds must be provided, with the corrosion inhibiting compounds being released at or adjacent the location where needed.

Granular silica gel is widely available for use as a desiccant. Frequently, granular silica gel is placed within a woven or knit pouch and placed within the confines of a package or enclosure for enveloping a corrosion-susceptible article. The granular material, when maintained at a particle size of below about 8µm may be utilized as a solid-phase substrate upon which powdered vapor phase corrosion inhibitor materials may be deposited.

When a laminate is formed in which one layer comprises a heat sealable film such as polyethylene with composite formulations of the present invention extruded in-situ, and with a second film layer being a material such as metallized stress-oriented polyethylene terephthalate films with desirable combinations of properties are achieved. Specifically, the polyethylene film layer retains its conventional heat sealing properties, while the stress-oriented polyethylene terephthalate provides a tear-resistant property. The metallized layer is utilized to reduce and/or eliminate static build-up, thereby further enhancing the properties and qualities of the laminate. Stress-oriented polyethylene terephthalate is normally biaxially oriented, and is, of course, commercially available. The composite vapor phase corrosion inhibiting/desiccant formulations of the present invention enhance the protective qualities of films which incorporate or otherwise include the composite materials.

The present invention provides a vapor phase corrosion inhibitor-desiccant formulation as set out in claim 1.

In accordance with the present invention, a solid phase material has been found which provides a source of vapor phase corrosion inhibiting material along with a substrate of granular silica gel. The vapor pressure of the composite material is balanced with the quantities normally required to be emitted for effective and long term protection of the metallic surfaces being exposed for treatment. The formulations of the present invention provide for emission of vapors in a concentration which is appropriate for strong protection of the metallic surfaces, and yet at a rate sufficiently low so as to provide for relatively long-lasting and long-term effective economic treatment. The presence of granular silica gel as a substrate for the vapor phase corrosion inhibiting component has been found to enhance the protective qualities of the product. The formulations of the present invention are compatible with and may be impregnated into foam such as an isocyanate-derived polymer foam, or extruded or otherwise deposited with synthetic resinous films, such as aliphatic hydrocarbon or olefinic films such as polyethylene and polypropylene. Such films may be incorporated with other films in a laminate, and in particular may be combined with a metallized film so as to enhance the static elimination and mechanical properties of the composite.

Additionally, the vapor phase corrosion inhibitor-desiccant formulations of the present invention have been found to produce little, if any, visible residue. The lack of residue enhances the utility of the materials, inasmuch as little, if any, mechanical or electrical problems result from the continuous use of these materials. Additionally, when granular silica gel component is used as a substrate for the corrosion inhibitor component, smoke and fume evolution of the corrosion inhibitor component is greatly reduced.

Typical corrosion inhibiting articles and materials used in the past are disclosed in Miksic et al U. S. Patent No. 4,051,066 and Miksic et al U. S. Patent No. 4,275,835.

The composite formulations of the present invention have been found to be particularly well adapted to

be housed in an air-permeable capsule for placement with an item to be protected, to be impregnated into foam, or to be combined as an extrudate with films fabricated from aliphatic hydrocarbon such as polyethylene and polypropylene. Generally speaking, the formulations of the present invention are utilized for retention and/or packaging within modestly porous envelopes or other enclosures formed of plastic film or plastic foam. Typically, those certain enclosures disclosed and claimed in the Miksic et al U. S. Patents 4,051,066 and 4,275,835, as identified hereinabove, are well adapted for use with the formulations or compounds of the present invention. Also, when extruded with a heat sealable film such as polyethylene, a metallized (aluminized) layer such as biaxially stress-oriented polyethylene terephthalate may be employed to enhance the mechanical properties of the overall film arrangement. Techniques for laminating these films together are, of course, well known in the art.

In use, the formulations set out in claim 1 provide a highly desirable balance between continuous emission from the solid phase, with this emission being at a rate sufficiently low so as to provide for relatively effective long-term and economic protection and treatment.

The granular silica gel component of the present invention preferably has a particle size range of less than about 8μm. Such granular silica gel is, of course, widely commercially available and as indicated above, provides a solid phase substrate for the vapor phase corrosion inhibitor component.

It is therefore a primary object of the present invention to provide an improved vapor phase corrosion inhibitor-desiccant which is particularly adapted for use in the protection of metallic surfaces exposed to environments which are corrosive to the exposed surfaces.

It is a further object of the present invention to provide an improved vapor phase corrosion inhibitor-desiccant which is formulated so as to possess a vapor pressure or other property which allows transport of the inhibitor to the metal surface appropriate for transport of appropriate quantities of the inhibitor from solid phase in the film to the metal surface, with the balance of the inhibitor being retained in the film, to provide a continuous supply of emitted corrosion inhibiting material.

It is yet a further object of the present invention to provide an improved vapor phase corrosion inhibitor-desiccant composite which is formulated so as to be capable of impregnation into a foam or extrusion with conventional aliphatic hydrocarbon resinous films such as polyethylene, polypropylene, and the like.

It is still a further object of the present invention to provide an improved vapor phase corrosion inhibitor-desiccant composite which is formulated so as to be capable of extrusion with conventional heat sealable films such as polyethylene, with such polyethylene films being, in turn, laminated to a metallized second film so as to enhance mechanical properties as well as static elimination properties of the composite laminate.

Another object of the present invention is to provide a foam product impregnated with the vapor phase corrosion inhibitor-desiccant material here described.

Yet another object of the present invention is to provide an air-permeable capsule containing the vapor phase corrosion inhibitor-desiccant material of the present invention for placement in the proximity of an item to be protected.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a cross-sectional view of a typical laminate prepared in accordance with the present invention, with the center or metallized layer being shown in somewhat exaggerated form due to limitations of draftsmanship;

Figure 2 is an enlarged cross-section of an open cell foam within which a corrosion inhibitor-desiccant formulation is impregnated;

Figure 3 is a roll or coil of the foam of Figure 2; and

Figure 4 is an air-permeable capsule in which a corrosion inhibitor-desiccant formulation is housed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

According the present invention, the vapor phase corrosion inhibitor component for the composite material to be supplied in an air-permeable capsule, incorporated with foam, or extruded polyethylene film comprises a mixture of amine benzoates, amine nitrates and benzotriazole as follows:-

Component	Percent by Weight
Cyclohexylamine benzoate	50% - 97%
Ethylamine benzoate	1% - 20%
Dicyclohexylamine nitrate	1% - 20%
Benzotriazole	1% - 10%

A particularly preferred embodiment is

Component	Percent by Weight
Cyclohexylamine benzoate	about 68%
Ethylamine benzoate	about 10%
Dicyclohexylamine nitrate	about 20%
Benzotriazole	about 2%

This mixture, also in powdered form and having a particle size below about 1 micron, is deposited upon granular silica gel, with relative weight ratios preferably from between about 45% vapor phase corrosion inhibi-

tor component, balance silica gel, although ratios of from between about 30% and 50% vapor phase corrosion inhibitor component, balance silica gel may be employed. The composite material is impregnated into foam at a concentration of from about 1% to about 30% by weight. It is extruded into polyethylene film at a concentration of from about 2% to about 3% by weight.

Preparation of compositions containing these components are prepared by simply blending the individual powdered components together.

While there are various techniques that may be employed for providing an appropriate extrudate including, for example, polyethylene and a vapor phase corrosion inhibitor-desiccant of the type described herein, one particular technique has been found to be particularly useful. Specifically, the composite formulation is formed and rendered as uniform in particle size and configuration as possible. This composite is then combined with a relatively limited quantity of polyethylene with the mixture then being passed through the barrel of a conventional extruder to form a master batch. The resultant master batch is then chopped and rendered into pellet form. These pellets are, in turn, combined with additional polyethylene and then extruded as the film containing a vapor phase corrosion inhibitor-desiccant of the type described.

Preparation of a foam-impregnated product is accomplished by dispensing a corrosion inhibitor-desiccant formulation of the present invention in a liquid carrier in which the foam is then immersed. The formulation becomes dispensed throughout the foam structure during immersion, and is there retained upon removal of the foam from the liquid carrier. Subsequent evaporation of the carrier is effectuated to thereby yield the impregnated foam product. An adhesive backing can be applied to the foam product to permit convenient placement and retention of the product at the site of needed protection.

A preferred air-permeable capsule product is constructed of a plastic vessel containing a corrosion inhibitor-desiccant formulation of the present invention and having an opening which is covered by an air-permeable Tyvek membrane (manufactured by Du Pont Co., Wilmington, Delaware) through which emission of the formulation can occur.

As has been indicated hereinabove, and with attention being directed to Figure 1 of the drawing, the vapor phase corrosion inhibitor-desiccant composite formulations of the present invention are well adapted for extrusion with resinous film material typically employed in the packaging industry. When employed as a member or layer of a laminate, and with continued attention being directed to the drawing, the film generally designated 10 includes a first layer of plastic film 11 having a metallic or metallizing layer 12 deposited thereon. Layer 13 of laminate 10 is impregnated with the composite formulations of the present invention, with the solid particles being introduced into the film through co-extrusion techniques. This impregnated film is, in turn, laminated to the metallized layer 12 of film 11 so as to form the ultimate composite. Laminating techniques for such films are, of course, well known in the art. Metallized films of biaxially oriented polyethylene terephthalate are readily bonded to and laminated with polyethylene films of the type shown at 13.

Figure 2 is an cross-section of foam 15 which is impregnated with a corrosion inhibitor-desiccant formulation of the present invention. The foam 15 is an open-cell isocyanate-derived polymer as known in the art. Retained within the cells 16 are discreet particles 17 of the inhibitor-desiccant formulation. These particles 17 are distributed within the foam by immersing the foam in a liquid in which the inhibitor-desiccant formulation is dispersed. The immersed foam 15 behaves much like a sponge in soaking up the loaded liquid to thereby achieve deposition of the inhibitor-desiccant formulation therewithin. Evaporation of the liquid results in impregnation of the formulation by particles 17. The impregnated foam 15 can be supplied in a roll or coil form 20 as shown in Figure 3, and can be provided with an adhesive backing 22 for adhered retention at a site. A section 23 has been cut from the roll.

Providing the corrosion inhibitor-desiccant formulation of the present invention in a permeable capsule 30 as shown in Figure 4 permits placement of the capsule in proximity to items to be protected. The body 32 of the capsule 30 is constructed of plastic, while a cover 34 is made of Tyvek®, a polymer having permeability characteristics which permit emission of corrosion inhibitor for deposition on items to be protected.

Vapor phase corrosion inhibitor-desiccant composites of the present invention are also well adapted for retention and/or packaging within modestly porous, air-permeable envelopes or other enclosures. These envelopes may be formed of plastic film or plastic foam, or alternatively, may be fabricated from cellulosic products such as paper or the like. In addition to being retained and/or packaged within envelopes or enclosures, the material may be placed upon or within an appropriate substrate formed of synthetic resin, foam or cellulosic materials. Typical examples of useful material include polyethylene, polypropylene, polymer foams, paper, and the like. When paper is employed, it is preferred that the drying operation be undertaken so as to provide reasonably anhydrous amine-molybdate materials.

Claims

1. A vapor phase corrosion inhibitor-desiccant formulation comprising a vapor phase corrosion inhibitor component and a desiccant component, wherein the corrosion inhibitor component comprises, by weight, from 50% to 97% cyclohexylamine benzoate, from 1% to 20% ethylamine benzoate, from 1% to 20% dicyclohexylamine nitrate, and from 1%

to 10% benzotriazole, and wherein the desiccant component comprises a granular silica gel, with said corrosion inhibitor component deposited upon said granular silica gel.

2. A vapor phase corrosion inhibitor-desiccant formulation as claimed in Claim 1 wherein the corrosion inhibitor component comprises, by weight, 68% cyclohexylamine benzoate, 10% ethylamine benzoate, 20% dicyclohexylamine nitrate, and 2% benzotriazole.

3. A vapor phase corrosion inhibitor-desiccant formulation as claimed in Claim 1 or 2 wherein the corrosion inhibitor component is a dry powder having a particle size less than 0.1 micron, and the desiccant component has a granular size between 2μm and 8μm.

4. A vapor phase corrosion inhibitor-desiccant, formulation and substate composite comprising

(a) a formulation according to any preceding claim, wherein the silica gel has a particle size between 2 μm and 8 μm;
(b) a substrate wherein the inhibitor-desiccant formulation is retained.

5. A vapor phase corrosion inhibitor-desiccant formulation and substrate composite as claimed in Claim 4 wherein the substrate comprises a foam.

6. A vapor phase corrosion inhibitor-desiccant formulation and substrate composite as claimed in Claim 5 wherein the inhibitor-desiccant formulation is present in the range of from 1% to 30% by weight.

7. A vapor phase corrosion inhibitor-desiccant formulation and substrate composite as claimed in Claim 4 wherein the substrate comprises an aliphatic hydrocarbon film selected from the group consisting of polyethylene and polypropylene, and wherein the inhibitor-desiccant formulation is retained within the substrate by extrusion therewith.

8. A vapor phase corrosion inhibitor-desiccant formulation and substrate composite as claimed in Claim 7 wherein the inhibitor-desiccant formulation is present in the range of from 2% to 3% by weight.

9. A laminate comprising first and second film layers bonded to a central metallic layer to form a composite structure wherein:

(a) said first film layer comprises the composite of claim 7 or 8; and
(b) said second film layer comprises a biaxially stress oriented polyethylene terephthalate.

10. A laminate as claimed in Claim 9 wherein the central metallic layer is a film of aluminum deposited upon the surface of said polyethylene terephthalate film.

11. A permeable capsule or a porous, air-permeable envelope, containing a vapor phase corrosion inhibitor-desiccant formulation according to claim 1 or 2.

Patentansprüche

1. Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung, die einen Dampfphasen-Korrosionshemmer-Bestandteil und einen Trocknungsmittel-Bestandteil enthält, wobei der Korrosionshemmer-Bestandteil 50 Gew.-% bis 97 Gew.-% Cyclohexylaminbenzoat, 1 Gew.-% bis 20 Gew.-% Ethylaminbenzoat, 1 Gew.-% bis 20 Gew.-% Dicyclohexylaminnitrat und 1 Gew.-% bis 10 Gew.-% Benzotriazol enthält und der Trocknungsmittel-Bestandteil ein granuläres Silicagel umfaßt und wobei der Korrosionshemmer-Bestandteil sich auf dem granulären Silicagel befindet.

2. Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung nach Anspruch 1, wobei der Korrosionshemmer-Bestandteil 68 Gew.-% Cyclohexylaminbenzoat, 10 Gew.-% Ethylaminbenzoat, 20 % Dicyclohexylaminnitrat und 2 % Benzotriazol enthält.

3. Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung nach Anspruch 1 oder 2, wobei der Korrosionshemmer-Bestandteil ein trockenes Pulver mit einer Teilchengröße von weniger als 0,1 μm ist und der Trocknungsmittel-Bestandteil eine Korngröße zwischen zwei 2 μm und 8 μm hat.

4. Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung-Trägerverbund, der aufweist:

(a) eine Formulierung nach einem der vorhergehenden Ansprüche, wobei das Silicagel eine Teilchengröße zwischen 2 μm und 8 μm hat, und

(b) einen Träger, in dem die Hemmer-Trocknungsmittel-Formulierung zurückgehalten wird.

5. Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung-Trägerverbund nach Anspruch 4, wobei der Träger einen Schaum umfaßt.

6. Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung-Trägerverbund nach Anspruch 5, wobei die Hemmer-Trocknungsmittel-Formulierung in einer Menge im Bereich von 1 Gew.-% bis 30

Gew.-% vorliegt.

7. Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung-Trägerverbund nach Anspruch 4, wobei der Träger einen Film aus einem aliphatischen Kohlenwasserstoff, der unter Polyethylen und Polypropylen ausgewählt ist, aufweist und die Hemmer-Trocknungsmittel-Formulierung in dem Träger zurückgehalten wird, indem sie damit extrudiert wird.

8. Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung-Trägerverbund nach Anspruch 7, wobei die Hemmer-Trocknungsmittel-Formulierung in einer Menge im Bereich von 2 Gew.-% bis 3 Gew.-% vorliegt.

9. Laminat, das eine erste und eine zweite Filmschicht aufweist, die an eine zentrale Metallschicht unter Bildung einer Verbundstruktur gebunden sind, wobei:

   (a) die erste Filmschicht den Verbund nach Anspruch 7 oder 8 aufweist und

   (b) die zweite Filmschicht ein biaxial spannungsorientiertes Polyethylenterephthalat aufweist.

10. Laminat nach Anspruch 9, wobei die zentrale Metallschicht ein Aluminiumfilm ist, der sich auf der Oberfläche des Polyethylenterephthalat-Films befindet.

11. Permeable Kapsel oder poröser, für Luft permeabler Umschlag, die/der eine Dampfphasen-Korrosionshemmer-Trocknungsmittel-Formulierung nach Anspruch 1 oder 2 enthält.

Revendications

1. Formulation d'inhibiteur de corrosion en phase vapeur-desséchant comprenant un constituant inhibiteur de corrosion en phase vapeur et un constituant desséchant, dans laquelle le constituant inhibiteur de corrosion comprend, en poids, de 50 % à 97 % de benzoate de cyclohexylamine, de 1 % à 20 % de benzoate d'éthylamine, de 1 % à 20 % de nitrate de dicyclohexylamine et de 1 % à 10 % de benzotriazole, et dans laquelle le constituant desséchant comprend un gel de silice granulaire, ledit constituant inhibiteur de corrosion étant déposé sur ledit gel de silice granulaire.

2. Formulation d'inhibiteur de corrosion en phase vapeur-desséchant selon la revendication 1, dans laquelle le constituant inhibiteur de corrosion comprend, en poids, 68 % de benzoate de cyclohexylamine, 10 % de benzoate d'éthylamine, 20 % de nitrate de dicyclohexylamine et 2 % de benzotriazole.

3. Formulation d'inhibiteur de corrosion en phase vapeur-desséchant selon la revendication 1 ou 2, dans laquelle le constituant inhibiteur de corrosion est une poudre sèche ayant une taille de particule inférieure à 0,1 µm, et le constituant desséchant a une taille granulaire entre 2 µm et 8 µm.

4. Composite de formulation d'inhibiteur de corrosion en phase vapeur-desséchant et substrat

   comprenant (a) une formulation selon l'une quelconque des revendications précédentes, dans laquelle le gel de silice a une taille de particule entre 2 µm et 8 µm ; et
   (b) un substrat dans lequel la formulation d'inhibiteur-desséchant est retenue.

5. Composite de formulation d'inhibiteur de corrosion en phase vapeur-desséchant et substrat selon la revendication 4, dans lequel le substrat comprend une mousse.

6. Composite de formulation d'inhibiteur de corrosion en phase vapeur-desséchant selon la revendication 5, dans lequel la formulation d'inhibiteur-desséchant est présente dans la gamme de 1 % à 30 % en poids.

7. Composite de formulation d'inhibiteur de corrosion en phase vapeur-desséchant selon la revendication 4, dans lequel le substrat comprend un film d'hydrocarbure aliphatique choisi dans le groupe constitué d'un polyéthylène et d'un polypropylène, et dans lequel la formulation d'inhibiteur-desséchant est retenue dans le substrat par extrusion avec celui-ci.

8. Composite de formulation d'inhibiteur de corrosion en phase vapeur-desséchant selon la revendication 7, dans lequel la formulation d'inhibiteur-desséchant est présente dans la gamme de 2 % à 3 % en poids.

9. Stratifié comprenant des première et seconde couches de film liées à une couche métallique centrale pour former une structure composite, dans lequel : (a) ladite première couche de film comprend le composite selon la revendication 7 ou 8 ; et (b) ladite seconde couche de film comprend un polyéthylène téréphtalate orienté à contrainte biaxiale.

10. Stratifié selon la revendication 9, dans lequel la couche métallique centrale est un film d'aluminium dé-

posé sur la surface dudit film de polyéthylène téréphtalate.

11. Capsule perméable ou enveloppe poreuse, perméable à l'air, contenant une formulation d'inhibiteur de corrosion en phase vapeur-desséchant selon la revendication 1 ou 2.

Fig.-1

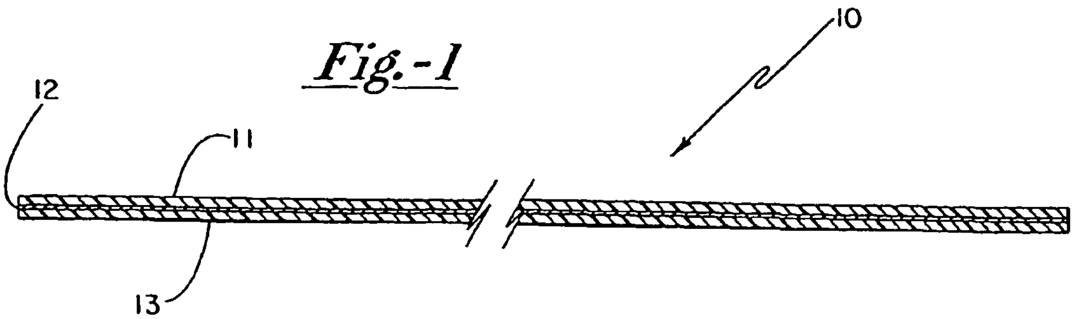

Fig.-2

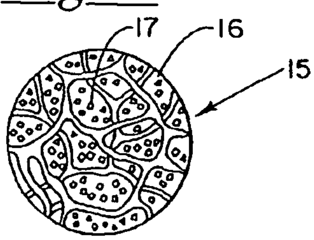

Fig.-3

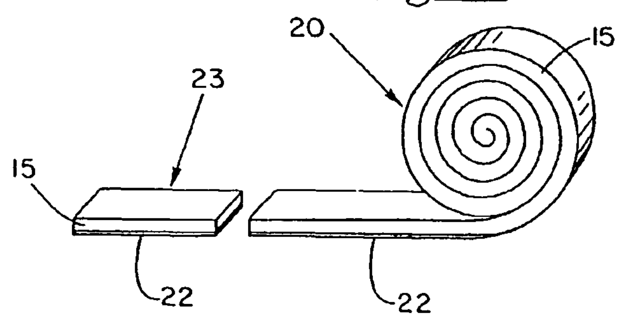

Fig.-4